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In the February number will appear:

Influence of anæsthetics on plant transpiration, by ALBERT SCHNEIDER, *University of Minnesota, Minneapolis.*

Flowers and insects, X, by CHARLES ROBERTSON, *Carlinville, Ill.*

Notes on North American Umbelliferæ, III, by JOHN M. COULTER and J. N. ROSE, *Bloomington* and *Washington.*

A comparative study of the roots of Ranunculaceæ, II, by FRED. B. MAXWELL, *University of Chicago.*

JUANULLOA SARGII, n. sp.

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BOTANICAL GAZETTE

JANUARY, 1893.

Undescribed plants from Guatemala. X.

JOHN DONNELL SMITH.

WITH PLATE I.

Sloanea pentagona (series AXILLIFLORÆ BRACHYSTACHYÆ Benth. Journ. Linn. Soc. v. Suppl. 62).—Ovary excepted glabrous: leaves coriaceous, nitid, entire, oblong ($7–9 \times 2\frac{1}{4}–3^{in}$), acuminate, base obtusish, midrib and six to seven pairs of long-ascending nerves salient on both surfaces with distinct transverse veinlets, petioles short (3^{l}): racemes subsessile, suppressed, few-flowered; pedicels incrassate, angular, ($6–8^{l}$), exceeding ovoid alabastra: perianth 4–5-merous: sepals thick, ovate-lanceolate, colored within: petals shorter, lanceolate: stamens bi-seriate, lightly cohering at base, linear anthers thrice exceeding filament, connective-mucronate: ovary velvety, pyramidate, concavely 5-angled, prolonged into short simple style, ovules in superposed pairs: developed flowers and fruit not seen.—A large tree with the habit of *Myrodia*, discovered by Baron von Türckheim on his estate at Pansamalá, Dept. Alta Verapaz, alt. 4,000^{ft}, Jan. 1889, (ex Pl. Guatemal. qu. edid. J. D. S. 1,411).

Xanthoxylum foliolosum (§PTEROTA Endl.).—Scandent, armed with short recurved prickles, blotched with exudations, glabrous throughout: leaves 10–15-jugate, rachis narrowly margined and aculeate; leaflets opposite, subsessile, shortly oblong (6×4^{l}), apex round, base truncate and biglandular, coriaceous, veins obsolete above, crenatures glandular, the odd leaflet ovate-oblong and longer, the lower pairs roundish and smaller: panicles axillary and terminal, a third as long as leaves, axes divaricate: sepals triangular, petals thrice longer, gynophore very short, carpids one to two and punctate: coccules one to two, nearly distinct, sessile, globose ($2\frac{1}{2}^{l}$), subequalling pedicels, glandular-tuberculate, endocarp adnate, epidermis of globose seed fleshy.—*X. Pterota* HBK., nearest in habit and technical characters, is distinct by obovate and less numerous

leaflets, long-stipitate and single coccules, etc.—San Rafael, Dept. Zacatepequez, alt. 6,500ft, Febr. 1892, J. D. S., (ex Pl. cit. 1,319.)

Ouratea podogyna (series OOCARPÆ §A, Engl. Fl. Brasil. XII2. 302).—Leaves elongate-oblong (12×3^{in}), caudately acuminate, narrowed to short petiole ($2-3^{l}$), obsoletely serrulate above middle, coriaceous, dull-green above, paler beneath; ascending nerves alone visible, impressed on upper surface, prominent on lower: slender panicle half as long as leaves, pedicels single or geminate and exceeding ovoid-lanceolate buds: sepals atrofuscous, caducous in anthesis, ovate-oblong ($3\frac{1}{4} \times 1\frac{1}{4}^{l}$), the three interior with scarious margins: petals obovate-oblong (4×2^{l}), exunguiculate: stamens equalling sepals, sessile, subulate-tetragonal, lightly rugulose: gynophore slender ($\frac{3}{4}^{l}$), 5-angulate: ovary half as long and twice broader, carpids short-oval and laterally compressed, style equalling petals: drupe not seen.—A tree 15–18ft high, with leaves resembling in form and size those of *O. gigantophylla* Engl., but with flowers more nearly those of *O. oliveformis* Engl. *O. Guatemalensis* Engl., var. (?) Watson, differs by smaller and membranaceous leaves with close horizontal veins, nearly simple raceme, short and thick gynophore, etc., (no. 39, Watson's Fl. Guat.!)—Pansamalá forest, alt. 3,800ft, Sept. 1886, von Türckheim, (ex Pl. cit. 1,034).

POTENTILLA DONNELL-SMITHII, described by Dr. Focke in BOTAN. GAZ. XVI. 3, is now identified by him as *P. heterosepala* Fritsch, whose publication during the previous year in *Botan. Jahrb.* XI. 314 had been overlooked.—Collected also by Dr. W. C. Shannon, Ass't Surg. U. S. A., associate of the Intercontinental Railway Commission, at Chichoy, Dept. Chimaltenango, alt. 9,000ft, Mch. 1892, (ex Pl. cit. 368); and by Messrs. Heyde & Lux at Chiul, Dept. Quiché, alt. 8,000ft, Apr. 1892, (ex Pl. cit. 3,321).

Fuchsia arborescens Sims, var. (?) **megalantha.**—Lower leaves quaternate: flowers nearly twice larger than in type: the greater stamens exceeding sepals, the lesser equalling style, anthers large ($1\frac{1}{2}^{l}$): stigma minute, ovary ellipsoid.—This is perhaps merely a strongly marked form of heterogonous dimorphism. The typical plant (perhaps only the more fertile form) was distributed as nos. 182 and 2,139 of this series.—Slopes of the Volcan de Acatenango, Dept. Zacatepequez, alt. 7,000ft, Mch. 1892, J. D. S., (ex Pl. cit. 2,469).

Hauya Rodriguezii.—Younger leaves, nerve-axils of the older, and ovaries, cano-pubescent; otherwise glabrate: leaves rhomboid-oval to elliptical ($3\frac{1}{2}$–$4\frac{3}{4} \times 2$–$2\frac{3}{4}$ in.), abruptly acuminate, obtusely or acutely angled at unequal base, eight to nine lateral nerves ascending straight to marginal arches: flowers large: lobes of calyx equalling tube ($2\frac{1}{2}$–3 in.), prolonged to subulate tips: petals two-thirds as long, oval: awns of anthers filiform ($2\frac{1}{2}$ l.): style equalling petals, stigma globose (4 l.): capsule subsessile, large (2–$2\frac{1}{4}$ in.), smooth, valves plane.—Compared at Kew by Mr. Hemsley with the originals of described species, and not identified. *H. elegans* Hemsl., as represented in this series of plants by nos. 2,527 and 2,528 determined by that gentleman, is a closely related species, differing chiefly by velvety or sericeous indument, round-oval leaves abruptly short-acuminate and with a rounded or subcordate base, relatively shorter calyx-lobes and longer petals and style.—A tree with a stout trunk, 30 ft. high.—Acatepeque, Dept. Zacatepequez, alt. 4,300 ft., Mch. 1892, J. D. S., (ex Pl. cit. 2,529). Named for Sr. lcdo. Don Juan J. Rodriguez, former Minister of the Interior, a distinguished student of *Lepidoptera*, in memory of hospitable and courteous attentions during my sojourn on his estates of Capetillo and Acatepeque situated on the southeastern slopes of the Volcan de Fuego.

Hauya Heydeana.—Arborescent (18 ft.), glabrous: leaves conterminously lanceolate ($3\frac{1}{2}$–$4\frac{1}{2} \times 1$–$1\frac{1}{4}$ in.), tipped with a gland, blotched with exudations: flowers small for the genus ($2\frac{1}{2}$–$2\frac{3}{4}$ in.), peduncles twice to thrice longer than petioles (12–18 l.): lobes of calyx shortly tipped, narrowly linear, exceeding tube: petals as long, twice broader, lanceolate: stigma ellipsoid: capsule about an inch long with narrow (2 l.) and plane valves.—A well marked species as respects both foliage and flowers, and especially distinct by the peduncle exceptional for the genus.—Beleú, Dept. Alta Verapaz, alt. 5,000 ft., Apr. 1892, Heyde & Lux, (ex Pl. cit. 2,935).—Dedicated to Sr. pbro. Don Enrique Th. Heyde, parish priest in Santa Rosa, as a slight but very sincere acknowledgment of my obligations to him for an extensive series of plants with duplicates, collected by him and his nephew, Don Ernesto Lux, in the departments of Quiché, Santa Rosa and Jalapa. Important additions to our knowledge of the Guatemalan flora may be expected from the further explorations, proposed by these gentlemen, of regions unknown to botanists, difficult of access,

and inhabited by indigenous races unfriendly to all strangers save such as visit them under the auspices of the church.

Parathesis micrantha. (*Ardisia micrantha* Donnell Smith BOTAN. GAZ. XIV. 26; not of HBK.).—In transferring this species to what recently received material shows to be its correct genus, the specific name preoccupied in *Ardisia* may stand in *Parathesis*, and indicates a character, alike abnormal in both genera, of minute cordate anthers. The bractlets are also seen to be oblong and ciliate.—San Miguel Uspantán, Dept. Quiché, alt. 6,000ft, Apr. 1892, Heyde & Lux, (ex Pl. cit. 3,020).

Bumelia pleistochasia.—Leaves smooth and shining, coriaceous, elliptical ($3–3\frac{1}{2} \times 1\frac{1}{4}–1\frac{1}{2}$in), obtusely acuminate, base acutely contracted into petiole ($4–5$l): fascicles densely flowered, equalling petiole: calyx obconic, as long as pedicel, incrassate segments round-ovate: appendages of corolla lateral, obliquely lanceolate, denticulate; proper lobes twice longer, oval, subentire: staminodes half the size of lobes, oval, fimbriate; ovary glabrous.—San Lucas, Dept. Zacatepequez, alt. 5,500ft, Apr. 1890, J. D. S., (ex Pl. cit. 2,184), distributed as *B. persimilis* Hemsl.—Palmer's no. 1,123 Fl. Mex. has been referred more correctly to that species by Mr. J. N. Rose, assistant botanist to the U. S. National Herb. With somewhat similar leaves it differs from the above by pubescence, smaller fascicles of less congested pedicels, cylindrical half-smaller calyx, oblong sepals, elongate lobes of corolla, nearly as long lanceolate staminodes, pilose ovary, etc.

Bumelia leiogyna.—Arborescent and spinose like the preceding, glabrous except the younger parts: leaves membranaceous, veinage distinct, elliptical-oblong to lanceolate ($2\frac{1}{2}–3 \times 1$in), apex obtusish, tapering acutely to short petiole: flowers minute (2l), subequalling pedicels and petiole, 6–10-fasciculate: calyx ovoid, half as long as pedicel; segments ovate with scariose margins, the interior ones puberulent: lobes of corolla obovate, denticulate, patent; appendages minute, subulate from an oval and lacerate base: staminodes also minute, rhomboidal, fimbriate: ovary glabrous, style shortly subulate.—The descriptions of *B. ferox* Cham. et Schl. indicate the nearest affinity, but ascribe to it opaque smaller and more generally obovate leaves, spatulate-lanceolate staminodes; and the ovary may be presumed to be normal and therefore hirsute.—Capetillo, Dept. Zacatepequez, alt. 4,500ft, Mch. 1892, J. D. S., (ex Pl. cit. 1,451).

Styrax conterminum.—Indument leprous, nowhere stellate, scales lacerate, ferruginous on branchlets petioles and calyx: leaves elliptical-oblong ($5–6 \times 1\frac{3}{4}–2^{in}$), conterminously acuminate, long-petiolate ($9–11^{l}$), coriaceous, scales of upper surface sparse, of lower continuous and silvery sprinkled with red: racemes chiefly simple, twice exceeding petioles; flowers large (7^{l}), pedicels as long and minutely bracteolate at base and middle: corolla silvery, thrice exceeding the minutely toothed calyx: filaments half-connate, twice longer than the short (2^{l}) and oblong anthers, exbarbate within, their exterior beset with fimbriate scales.—The other three species of the lepidote group, all South American, can be distinguished by their leaves: in *S. ovatum* A. DC. ovate-lanceolate (838 Rusby Fl. S. Am.! 467 Bang Pl. Boliv.!): in *S. cordatum* A. DC. cordate-ovate: in *S. leprosum* Hook. et Arn. obovate-oblong and small (H. 46 ex herb. Regnell.!).—A small tree; San Miguel Uspantán, Dept. Quiché, alt. 6,000ft, Apr. 1892, Heyde & Lux, (ex Pl. cit. 2,915).

Ehretia Luxiana.—Branchlets and axes of inflorescence angulate, beset with linear red lenticels: leaves tuberculate at their axils, glabrous, oval with obtuse ends or elliptical with somewhat acuminate apex and more acute base ($2\frac{1}{4}–4\frac{1}{4} \times 1\frac{1}{2}–2\frac{1}{4}^{in}$), serrate above middle: panicle terminal, shorter than leaves, corymbose, densely flowered, slightly pubescent: flowers among the smallest of the genus (3^{l}): calyx a third as long, campanulate, broadly and obtusely lobed to middle: lobes of corolla exceeding tube, oblong, revolute.—Habit and inflorescence are those of *E. Mexicana* Watson (3,085 Pringle Fl. Mex.!), which differs by hispid lanceolate leaves, and still smaller flowers with sharply partite calyx and shortly lobed corolla.—Arborescent (15^{ft}). Called by the Indians "Pepi Nanci."—San Miguel Uspantán, alt. 6,000ft, Apr. 1892, Heyde & Lux, (ex Pl. cit. 3,065).

Juanulloa Sargii (§ EUJUANULLOA Dun. in DC. Prodr.).—Leaves membranaceous, glabrate above, sprinkled beneath with stellate pubescence, obovate to rhomboidal or elliptical ($5–7 \times 2–4^{in}$), apex rounded, base cuneate, petioles short (3^{l}) and tomentose: peduncles axillary and terminal, elongated ($3–5^{in}$), forking, coriaceous flowers racemose on dichotomous flexuose axes of panicle: calyx ochraceous-tomentose, red within, campanulate, contracted into short ($3–4^{l}$) pedicel; partitions elliptical-oblong ($10 \times 3\frac{1}{2}^{l}$), acute, two-thirds coher-

ing, in fruit separating: corolla more than twice longer, inflated above middle, aureate-pubescent, red within: anthers linear (6^{l}), more than half as long as filament: berry globose-ovoid (10^{l}), seeds oblong and foveolate.—A sarmentose shrub 4–5^{ft} high, with foliage crowded toward ends of the short branchlets, scarred with verrucose articulations of fallen leaves and flowers.—Banks of a brook near Escuintla, Dept. Escuintla, alt. 1,100^{ft}, Mch. 1892, J. D. S., (ex Pl. cit. 1,467).—The name proposed is that of my esteemed friend, Mr. Francis C. Sarg, consul of the German Empire for Guatemala, an accomplished naturalist, who has contributed valuable material to the entomological volumes of *Biologia Centrali-Americana.*

EXPLANATION OF PLATE I.— Fig. 1, flowering branch. Fig. 2, fruiting panicle. Fig. 3, flower exposed with corolla removed. Fig. 4, corolla laid open. Fig. 5, pistil. Fig. 6, fruit. Fig. 7, seed. (Figs. 1–4 are natural size; the others are variously magnified.)

Tynanthus Guatemalensis.—Undeveloped leaves, axes of inflorescence, and corolla, cano-furfuraceous: leaves nearly glabrous, twice exceeding common petiole, seldom cirrhose; leaflets more usually three, long-petiolulate (6–11^{l}), elliptical ($2\frac{1}{4}$–3×1^{in}), caudately acuminate, apex blunt, membranaceous, the terminal the greatest, with half-longer petiolule and an acute base, the lateral obliquely rounded at base: thyrsi terminal and geminate or becoming axillary, shorter than leaves, primary axes brachiate, of cymules rectangular-divaricate and capillary, bractlets minutely subulate: calyx campanulate, transversely truncate, teeth and nerves obsolete: corolla more than thrice longer (3–$3\frac{1}{2}^{l}$), white, labiate to middle, furfuraceous lobes of reflexed anterior lip orbicular and unequal, elsewhere within glabrous: stamens and minute ($\frac{3}{4}^{l}$) inappendiculate staminode equally inserted near base of tube, glabrous: ovary conic, cano-hirsute: capsule not seen.—According to Prof. Bureau's grouping of other species, all South American, this is to be collocated with *T. Goudotiana* Bur., which is distinguishable by an obliquely truncate calyx with a large posterior tooth.—Climbing over trees and flowering profusely.—Banks of Rio Ocosito, Dept. Quezaltenango, alt. 250^{ft}, Apr. 1892, J. D. S., (ex Pl. cit. 1,488).

Schlegelia cornuta.— Epiphytal, procumbent, branches scabrid with setose tubercles and pilose: leaves obovate ($2\frac{1}{2}$–$4\frac{1}{4} \times 1\frac{3}{4}$–$2\frac{1}{2}^{in}$), apex rounded or retuse, tapering to short petiole,

thick-coriaceous, smooth and shining, margins revolute, nerves few and robust: peduncles axillary, short (3–6^{l}), pilose; pedicels 3–7-fasciculate, half or two-thirds as long as flowers: tube of calyx obpyramidate, pentagonal, lobes twice longer (4–5^{l}) and subulate by conduplicately cohering margins: corolla evenly cylindrical (15–17 × 2½^{l}), throat scarcely ampliate, lobes subequal (2^{l}): stamens included, twice exceeding staminode, insertion barbate, anthers reniform by diverging oval cells: disk none: berry depressed-globose (4 × 5^{l}), fleshy; seeds ten to twelve, scariose-alate, enveloped in fibrose pulp.— A pseudo-parasitic shrub, not repent.—San Miguel Uspantán, alt. 8,000^{ft}, Apr. 1892, Heyde & Lux, (ex Pl. cit. 3,044).

Ægyphila falcata.—Branchlets tetragonal, thickened at nodes, smooth: petioles brachiate, canaliculate, short (6–9^{l}); leaves chartaceous, nitid, faintly punctate, oval (7–9 × 4–5^{in}), the younger ovate-oblong, each end broadly rounded and abruptly short-acuminate, falcate, base conduplicate, midrib salient beneath, costal nerves robust: axillary cymes half-equalling leaves and long-pedunculate, the terminal thyrsoid and brachiate, nodes complanate, foliaceous bracts lanceolate, axes fastigiate, bractlets subulate: flowers 4-merous, subdiclinous, dimorphous, puberulent, shortly pedicellate: calyx obpyramidate, mouth nearly truncate: corolla reddish-yellow, hypocraterimorphous, narrow tube one to four times as long as calyx, limb ampliate (2½^{l}), stamens all more or less pollen-iferous, the semi-abortive included in short corolla, the others twice exceeding elongate corolla.— A symmetrical tree 30–40^{ft} high, with a habit other than that of *Æ. clata* Swz. by its foliage and abundantly axillary inflorescence, and with the dimorphous flowers of *Æ. arborescens* Vahl.— Escuintla, alt. 1,100^{ft}, Apr. 1890, J. D. S. (ex Pl. cit. 2,111), distributed as *Æ. clata* Swz.: San Felipe, Depart. Retalhuleu, alt 2,000^{ft}, Apr. 1892, J. D. S., (ex Pl. cit. 1,479).

Baltimore, Md.

A comparative study of the roots of Ranunculaceæ.

FRED B. MAXWELL.

WITH PLATES II–IV.

I. Historical Introduction.

After the beginning of the present century, when plant anatomy began seriously to attract the attention of botanists, the cell wall was the first subject of investigation; then the actively growing parts above ground; and finally the roots of plants were studied. Nevertheless the latter have received far less attention proportionally than the other organs of plants.

In reviewing the history of the microscopic investigation of roots the development of the subject appears in two distinct periods.[1] Previous to 1865 anatomists such as Mirbel, von Mohl, and Trecul, studied the various masses of tissues making up roots, and the cells composing them. Since 1865 study has been more directed to the origin of organs and the various parts of organs. Among the more important writers of this period are Nägeli, Hanstein, Reinke, Janczewski, Treub, Erickson and Flahault.

The first period dealt with the histological elements in and for themselves, the second went farther and sought their origin and development; the first mainly investigated mature organs, the second took up the study of the young and newly formed parts, the meristem, especially in their relation to the formation of the mature parts.

In 1810 Mirbel,[2] the earliest of the important writers of the first period, studied the roots of *Nymphæa lutea*, and in 1831 Hugo von Mohl,[3] from the study of the roots of a palm, made the distinction between the central cylinder, cortex, and epidermis. Trecul,[4] among other histological articles published one in 1846 concerning the origin of roots.

Although in time belonging to the second period, I will refer here to a series of articles by Van Tieghem, since these

[1] For the résumé of the works of the earlier writers I am indebted to the admirable articles by Flahault, Janczewski and Olivier.

[2] Examen de la division des vegetaux en endorhizes et exorhizes. Comptes rendus, Oct. 8, 1810. Ann. du Museum, XVI.

[3] De Palmarum structuro.

[4] Recherches sur l'origine des racines. Ann. des Sci. Nat. III. v. 340.

articles dealt more with general plant anatomy than with meristematic structure, the first article[5] dealing particularly with root structure. After stating that certain arrangements of tissues are only found in certain organs, he takes up each organ and studies the modifications of the fundamental structure for that organ, as found in the various classes, orders, genera, etc., of plants. He points out the distinction between root and stem structure, as based on the arrangement of the fibro-vascular bundles, the former normally having radial bundles, the latter collateral ones, though older roots of dicotyledons take on an arrangement similar to the stem structure. He was not the first, however, to call attention to the change taking place in the roots of dicotyledons, since Nägeli as early as 1858[6] had shown that the older roots of many dicotyledons possessed a different structure from the younger roots of the same plant, and that the condition of the younger roots of dicotyledons was the permanent condition of the roots of monocotyledons.

The first important generalization concerning meristem structure to receive immediate consideration of other workers was made by Nägeli and Leitgeb.[7] They found that in vascular cryptogams the several zones of tissues of both stem and root were derived from a single apical cell situated in the vegetative point. All vascular cryptogams studied showed this structure, and they assumed that phanerogams would present a similar development at the growing point, and in young roots they asserted that all the tissues could be traced to a single apical cell as their origin, but in older roots later growth concealed this primary structure. Before this time Otto Nicolai[8] had said that the vegetative point in phanerogams was a group of cells, which, by means of successive division, formed on one side the root cap and on the other the body of the root.

In 1868 Hanstein[9] declared that in phanerogams, the initial at the vegetative-point is never of a single cell, but of a

[5] Ann. des Sci. Nat. V. XIII.

[6] Sur l'accroissement de la tige et de la racine dans les plantes vasculaires. Beiträge zur wissensch. Bot. 1858.

[7] Entstehung und Wachsthum der Wurzeln Beiträge zur wissensch. Botan. *4*, 138.

[8] Das Wachsthum der Wurzel, 1865.

[9] Die Scheitelzellgruppe im Vegetationspunkt der Phanerogamen. Bonn. 1868.

group of cells, and added that the root-cap was from sister cells separated from the epidermis. To the meristematic epidermis he gave the name of dermatogen. In 1870[10] he confirmed this first assumption in a paper, the conclusions of which were quite generally accepted at the time. According to him the cortex and central cylinder each has an initial group of its own, and the root-cap is derived from the epidermis, one being able to trace it for a certain distance under the root-cap. He completely exploded Nägeli's theory of a single apical cell for phanerogams, but he fell into an error similar to Nägeli's in supposing that all phanerogams followed the type explained above. Hanstein was followed by a pupil of his, Reinke[11], who, by the study of mature roots, confirmed Hanstein's conclusions, Hanstein's studies having been made on the roots of embryos. Although Reinke examined but few roots, and all of those of angiosperms, he held that all phanerogams had the structure of the one species especially examined, that is *Helianthus annuus*. Reinke admitted some variations from type, but held that these were not of enough importance to found a new type.

Prantl[12] opposed Reinke's general statement, saying that in maize the epidermis was distinct from the root-cap, possessing an initial group of its own, and in Pisum and Vicia he found that the primitive tissues were confluent at the vegetative-point. In a short note[13] Reinke had already admitted that in *Pinus pinea* the root-cap was not from the dermatogen, but from the periblem, or perhaps that the root-cap was absent and that the cortex served its purpose, being thrown off and developing again.

About the same time Strasburger[14] published a memoir in which he held that all *Coniferæ*, *Gnetaceæ* and *Cycadeæ* have the structure made out for *Pinus pinea*. Reinke admitted that this was probably true. The appearance of doubtful cases has made uncertain the acceptance of Hanstein and Reinke's theory of one type of meristem structure for the roots of all

[10]Die Entwicklung des Keimes der Monocotylen und Dicotylen. Botan. Abhandl. aus d. Gebiete der Morphologie und Physiologie. I. Bonn. 1870.

[11]Untersuchungen über Wachsthumgeschichte und Morphologie der Phanerogamenwurzel. Botan. Abhandl., etc., III, 1871.

[12]Regeneration der Vegetationspunktes an Angiospermenwurzeln. Arb. des Bot. Instituts Würzb. *4*, 1874.

[13]Bot. Zeit. 1872.

[14]Die Coniferen und Gnetaceen. Jena 1872.

phanerogams and it only needed Russow's[15] article to prove that this type was not a universal one. Mainly through the study of embryos he compared the roots of phanerogams with those of vascular cryptogams. He found that the roots of all phanerogams did not follow the Helianthus type, for in the embryos of several *Leguminosæ* and in many older roots of dicotyledons one could not trace the epidermis under the root-cap, on the contrary the dermatogen entered the primary meristem of a continuous layer; and he found that in many roots there was no distinction between the dermatogen and the periblem, or between the dermatogen and calyptogen, and sometimes the periblem and plerome were not distinctly separated.

In 1874 appeared Janczewski's[16] very important memoir. He reviewed the work that had preceded his, especially criticising Reinke, asserting that he endeavored to prove a preconceived conclusion, and that his investigations were not sufficiently accurate and extended to base important deductions upon. In making his investigations Janczewski studied the roots of embryos, developing roots, and mature roots, the best results being obtained from the study of the latter, and he bases his conclusions upon this study. He proposed five principal types of meristem structure at the growing-point in the roots of phanerogams. His five types are as follows:

First type, roots having four independent primary tissues at the vegetative point, and so four initial groups, a calyptrogen, a dermatogen, a periblem and a plerome. He placed but two plants in this type, *Hydrocharis* and *Pistia*.

Second type, roots having three independent primary tissues, a sharply defined calyptrogen and plerome, and between these an initial group from which arise the cortex and epidermis, or perhaps no true epidermis present, the outer layers of the cortex taking its place. This is the type to which he assigns most of the monocotyledons.

Third type, roots with three primary tissues, the plerome and periblem being sharply defined but the epidermis and root-cap having a common origin. Here he would include most dicotyledons.

[15] Vergleichende Untersuchungen, etc., der Phanerogamen, ausgehend von der Betrachtung der Marsiliaceen. Mém. Acad. de St. Petersburg, VII. xix (1872).

[16] Das Spitzenwachsthum der Phanerogamenwurzeln. Bot. Zeit. 1874.

Recherches sur le developpement des radicelles dans les Phan. Ann. des Sci. V. xx.

Fourth type, root with but one primary tissue at the vegetative point, the initial groups of all tissues being confluent, or perhaps we should say possessing a common initial group for all the tissues. Example, some *Cucurbitaceæ* and *Papilionaceæ*.

Fifth type, roots with two primary tissues, the plerome and periblem being distinct, and the outer layers of the cortex serving the purpose of an epidermis and root-cap. To this type belong the gymnosperms.

It will be seen that the first four types pertain to angiosperms and the last to gymnosperms, while the first two includes monocotyledons, and the third and fourth dicotyledons. Hanstein and Reinke's general type is Janczewski's third type, while the fifth type confirms Reinke and Strasburger's work on gymnosperms.

Hegelmaier[17] from the study of embryo roots, would add at least two other monocotyledons to Janczewski's first type. He says that at a very early stage the root-cap is formed by tangential division from the dermatogen, and later growth is by centripetal division of this layer and not from the dermatogen.

In 1876 two important articles upon meristem structure appeared. Treub, from a study of the roots of monocotyledons,[18] would make three types of terminal meristem structure for them, retaining Janczewski's first type and dividing the second into two others. Erickson,[19] from a similar study of dicotyledons would make four types of meristem structure for them. His types are as follows:

First type, roots having three well marked meristem tissues at the vegetative point, a plerome, a periblem, and combined dermo-calyptrogen layer, from which both the epidermis and root-cap arise. This is Janczewski's third type.

Second type, but two well marked meristem tissues in the root, a distinct plerome and a common initial for the cortex, epidermis and root-cap. In this type Erickson places several *Malvaceæ* and scattered species from other groups.

Third type, a common origin for all the tissues, the initial of all the groups coalescing. This is Janczewski's fourth type.

[17] Zur Entwicklung monocotyl. Keime, etc. Bot. Zeit. 1874.

[18] Le meristeme primit. de la racine dans les monocot. Leyden, 1876.

[19] Ueber das Urmeristem der Dicotylenwurzeln. Jahrbücher für wissensch. Botan. Leipzig, 1877.

Here Erickson includes most of the *Leguminosæ* and a few species from several other groups, including all of the *Ranunculaceæ* which he examined, though saying that these differed from the type in that the periblem developed centrifugally instead of centripetally.

Fourth type, roots having but two well marked meristem tissues, a plerome and a periblem, the outer layers of the cortex answering to the epidermis and root-cap. This agrees with Janczewski's fifth type which he made for gymnosperms.

In an article published in 1878[20] Flahault discusses the theories of structure of the root at its vegetative tip. He thinks that it was on account of Hanstein and Reinke not understanding the early separation of the calyptrogen from the dermatogen that they placed monocotyledons in the Helianthus type. After making a study of the roots of three hundred and fifty species, representing nearly all of the natural orders of plants, he makes two types of primary meristem for angiosperms, one for dicotyledons and one for monocotyledons, distinguishing the two types by the latter always having a distinct calyptrogen layer. The other types as made out by Janczewski and others he would regard as but forms of these two, for between them are all manner of gradations, while the two main types are very distinct.

Fleischer[21] found that in a *Juncus* and *Luzula* the root-cap had an origin of its own while other plants he studied conformed to the Helianthus type. Bruchman claimed to have made out four primary meristem tissues in the roots of grasses which he studied, but did not give details of work or results.

Thus we see that later workers agree that Hanstein and Reinke's assumption of one type of meristem structure for all phanerogams was untenable. As to how many types there are opinions differ widely.

M. Halle[22] tried to reduce Janczewski's two types for dicotyledons to one type, and adds a number of species as belonging to the Helianthus type. He considered Janczewski's fourth type the result of degeneration through excessive development at the vegetative point. He made careful studies of the embryos of many *Leguminosæ*, said to belong to this

[20] Recherches sur l'accroissement terminal de la racine chez les phanerogams. Ann. des Sci. Nat. VI. vi.

[21] Beitræge zur Embryogenie der Monokotylen und Dikotylen. Flora, 1874.

[22] Bot. Zeit. 1876 and 1877.

fourth type, and found that in this stage they followed the Helianthus type and only later were the initial groups merged into one. Hence he would not consider this as a distinct type. He also points out divergencies from type structure in the roots of other plants, and considers Janczewski's first type but a variation of the second, since he thinks in the roots of *Vallisneria spiralis* he found an intermediate form between the two types. He agrees with Russow that the root must be studied in all stages of development before we can arrive at safe conclusions.

Flahault says of Halle's paper that it furnished important conclusions, but that the number of species studied were too few and the reasons given were not sufficient to put a stop to all discussion, and after his own more extended studies he arrives at about the same conclusion and would make but two general types of meristem structure for the roots of angiosperms.

In 1877 De Bary[23] made a résumé of the work accomplished on the meristem of roots. After discussing the work of various authors he asks, "If the organization of the different systems of tissues, and the structure of the organs ought to be considered as connected with the organization of the terminal meristem, and also if each tissue always takes its birth in the same part of the primary meristem." After reviewing the principal modifications of the structure of the vegetative point of the root, he says, "Determined zones of meristem are not always to be considered as the origin of determined tissues, although it might be so in many cases."

While the résumé which we have made shows us that much has been done in investigating the structure of the vegetative point of roots, it also shows us that there is much confusion as to the types of structure which should be recognized, which confusion can only be cleared up by a careful study of the roots of all the natural orders of plants.

I have undertaken to make a study of the roots of the native *Ranunculaceæ*, especially as to the meristem of the vegetative point, but also somewhat as to the general histological structure of the root. The results of this study will be found in parts II and III of this paper, but before taking up that study the following résumé of work already done on the roots of this order may be found useful.

[23] Vergleich. Anat. der Vegetationsorgane, etc.

Having had access only to reviews of many of the earlier articles referred to in this paper, I cannot say whether some of them may not have worked upon this group, but the titles of their papers would indicate that many of them had not done so. Of the more important articles which I reviewed I find that neither Van Tieghem nor Janczewski appears to have included any of the *Ranunculaceæ* in their studies. Erickson, as already referred to, studied the roots of several of the *Ranunculaceæ*, among them being *Ranunculus repens*, of which he gives a figure of the meristem, and *Caltha palustris*. Flahault, in his article published in 1878, refers to the structure of the roots of several of this order, and he agrees with Erickson that the tissues merge into one at the vegetative point, but would say that this was but a modification of the general type for dicotyledons. He figured the root tip of *Pæonia officinalis* and *Aconitum pyrenaicum*. Hegelmaier, in an article on the growth of the embryo in dicotyledons, treats at length of several *Ranunculaceæ*, but gives slight reference to the root structure, and does not dwell on the meristem of the growing-point. Olivier[24] treats mainly of the histological structure of roots and places *Ranunculaceæ* in a class of plants in which the secondary vascular tissue appears very late, adding that in the roots of the genus *Ranunculus* there is less secondary vascular development than in any other dicotyledon. He says of the genus *Thalictrum* that the secondary growth appears late, and but very little developed, that the cortical parenchyma is often nearly all exfoliated, the endodermis being persistent and then serving the purpose of an epidermis. De Bary discusses the root structure of several of the *Ranunculaceæ*, and gives figures of the cross-section of the root of *Ranunculus fluitans* and *R. repens*. P. Marie[25] gives an important article on the histological structure of *Ranunculaceæ*, referring to the general histological structure of the roots as well as to that of the stem, etc., but he does not refer to the meristem structure. He gives many good figures of root structure.

Prof. Hargitt[26] published a short article in the BOTANICAL GAZETTE, in which he describes the structure of the roots of *Isopyrum biternatum*.

[24] Recherches sur l'appareil tegumentaire des racines. Ann. des Sci. Nat. VI. II.

[25] Recherches sur la structure des Ranonculacees. Ann. des Sci. Nat. VI. XX.

[26] BOTAN. GAZETTE XV (1890). 235.

Thus we see that work upon the roots of this order, especially as to the meristem, has been very limited. In the parts of this paper which follow I have endeavored to point out certain types of structure, as I have found them in the roots of the native species of *Ranunculaceæ*.

University of Chicago.

Method for obtaining pure cultures of Pammel's fungus of Texas root rot of cotton.[1]

GEO. F. ATKINSON.

It is not a very difficult matter to obtain artificial pure cultures of spore producing fungi which grow readily in artificial nutrient media. But when we meet with forms of fungi, the spore production of which is unknown, quite a serious difficulty is encountered since spores of other fungi, as well as numerous bacteria, are so apt to be securely lodged in the strands of the mycelium. This serious difficulty is increased when the fungus in question shows a decided aversion to growing on the usual artificial media. The fungus of Texas root rot of cotton, described by Pammel in Bulletin no. 7 of the Texas Agricultural Experiment Station, has not yielded to the methods usually resorted to in obtaining pure cultures.

After trying various methods Pammel failed to obtain a pure culture. In one case threads of the fungus were swept with a camel's hair brush with the hope of obtaining spores. A "pure culture of some fungus" was obtained but its morphological characters were unlike those of the fungus found on the roots of cotton.

During the summer of 1891, at Auburn, Ala., I made several attempts from fresh material received from Texas to induce the fungus to part its hold on the cotton roots and grow under my care and observation. All attempts at that time failed. Affected roots were placed on sand in moist chambers and the fungus strands grew in several cases from four to six inches out over the surface of the sand. When portions of these strands were transferred to nutrient media they failed to grow.

[1] Paper presented before the Botanical Section of the Am. Assoc. Agr. Coll. and Exp. Sta. New Orleans, Nov. 16, 1892.

In the summer of 1892 I undertook the work again since my labors in the south were soon to end and I was very anxious to obtain a pure culture of this extremely interesting and important organism. I was well supplied with fresh material which was being received once or twice each week.[2] Most of the roots were sent by Mr. R. D. Blackshear, to whom I am especially indebted for the patience and care manifested in gathering and shipping the specimens. Each root was wrapped separately with moist paper retaining a small portion of the earth next it, and several such roots then bound into a single package. They were usually received two days after being removed from the ground. While the roots were en route I prepared several large moist chambers in the following way: A layer of sand about one-half inch deep was placed in the lower vessel and covered with four thicknesses of filter paper. The sand and paper were then well moistened with distilled water, the cover placed in position, being elevated somewhat from the rim of the lower vessel by two tufts of moist cotton to allow free movement of air and steam, this precaution being necessary to avoid breaking the glass while being sterilized. The moist chambers were then piled in a large dry oven, the temperature of which was raised to 140°C. for an hour or two on two successive days. The filter paper was first perforated in several places to prevent its being raised from the sand by steam. When sterilization was complete the tufts of cotton separating bottom and cover were removed.

On receipt of the roots they were carefully unwrapped, the earth removed, the roots rinsed with distilled water, cut in sections about 5^{cm} long and placed horizontally on the filter paper, four or five sections in each moist chamber.

In two or three days the strands of the *Ozonium* could be seen growing out over the filter paper for 4^{cm} to 6^{cm} away from the root. The strands were examined microscopically to determine the fungus. Sterilized glass slides were now placed at the advancing edge of the strand or weft, and upon these were placed small sections of cotton roots, which had been previously boiled and then steamed for several hours for three or four successive days, to thoroughly sterilize them. Sections of such roots about 3^{cm} long were placed, with the aid

[2]Through the kindness of Prof. Geo. W. Curtis, Dir. of the Agri. Exp. Sta., Mr. R. D. Blackshear, Navasota, and Mr. W. H. Farley, Hutto, Texas.

of forceps reddened in the flame, upon the sterilized glass slide, so that one end came in contact with the weft or strand of the *Ozonium*.

At the same time similar sections of sterilized cotton roots were placed in test tubes and partly imbedded in moist sand or partly immersed in distilled water, the tubes with their contents afterwards being thoroughly steam sterilized.

In from twenty-four to forty-eight hours the *Ozonium* strands would bite hold of the bait placed before them and secure such firm hold that the section of root could be transferred bodily to the prepared culture tubes, placing the end containing the growth in contact with the sterilized root already in the tube. Sterilized sweet potatoes were also used in test tubes as a medium upon which to place the transplantings.

Since the fungus grew rather slowly, and there was always danger that it might be contaminated by other fungus threads which had crept along with it, or with bacteria, some thirty or forty moist chambers during a period of six weeks were used, and more than 200 baits were set for the fungus. Out of this number seventy-five baits, which were promising, were transferred to roots in the culture tubes, and from these four or five finally proved to be pure. From these, baits could now be easily handled, so that in the course of two weeks I had multiplied the cultures to the number of fifty.

Great difficulty was encountered in baiting in such a way as to avoid contamination from strands and wefts of *Œdocephalum*, several species of *Fusarium*, *Penicillium*, *Mucor* and some non-fruiting forms, which also grew out from the roots and crept over the filter paper. In several cases bacteria were starved out by making the medium slightly acid with the use of lactic acid.

The *Ozonium* on artificial media, as sterilized cotton roots or sweet potatoes, grows readily after once obtaining a firm hold, and possesses all the characteristics observable in a natural condition upon cotton roots. Being free from obstructions and hindrances which it encounters in nature, the growth is perhaps much more compact, numerous strands uniting to form a broad weft, but the peculiar strands are present, as well as the characteristic branching setæ.

In the first transplantings the fungus grew with difficulty, since I did not have the conditions perfect, but as with expe-

rience I became more and more familiar with its habits, I found it an easy matter to cultivate it with certainty and in profusion.

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A vacation in the Hawaiian Islands.

DOUGLAS HOUGHTON CAMPBELL.

(Concluded from p. 416.)

Of the trees of this lower forest region, much the most conspicuous is the Aleurites Moluccana, a euphorbiaceous tree, called by the natives kukui, with pale silvery green foliage which makes it noticeable at a long distance. The large oily seeds are used as food; and, formerly at least, the expressed oil was used for various purposes. A little higher up, the koa (Acacia koa), one of the commonest forest trees, abounds. This has phyllodia, like so many of the Australian acacias, and it is the principal timber tree, the wood being not unlike mahogany in appearance. Another conspicuous tree of the higher forest region is the ohia, or mountain apple (Eugenia Malaccensis), one of the Myrtaceæ, a medium-sized tree with beautiful crimson fruits not unlike a bell-flower apple in shape. The pulp is white and watery, pleasant to the taste, and very refreshing. Higher still, the related Metrosideros is very abundant, and with its grey-green leaves and scarlet feathery flowers is a striking object.

Owing to the almost constant rains, most of the valleys are traversed by permanent streams, and the floors of these valleys are very productive. Here are found the principal taro plantations. The taro plant (Colocasia antiquorum), familiar enough in American gardens under the name of Caladium esculentum, is the food staple of the great majority of native Hawaiians. Its large farinaceous tuber, after being deprived of its acrid properties by heat, is either directly baked or boiled for eating, or, more commonly, the baked taro is ground up with water into a sort of porridge, allowed to ferment, and served in the form of "poi". This is a sticky, unpleasant-looking mess, which, nevertheless, appears to be very nutritious.

Beside visiting the isle of Oahu, I made short trips to the islands of Hawaii and Kauai. The former, the largest of the group, and the only one where volcanic action is still going on, is reached by steamer in about thirty-six hours from Honolulu. On the way, the islands of Molokai, Lanai, and Maui are passed. The first, a barren looking and forbidding spot, is the location of the leper settlement, to which all persons afflicted with leprosy are sent as soon as their condition becomes known.

Maui, the largest of the islands next to Hawaii, consists of two portions connected by a narrow isthmus. The whole eastern half is nothing more nor less than the body of an immense extinct volcano, ten thousand feet high, and with a crater nearly ten miles across. The other end of the island is an older formation. This island is said to be very interesting botanically; but, unfortunately, my time did not permit me to visit it.

Very soon after sighting Maui, the three great mountain masses of Hawaii began to loom up. The day was clear, and the whole formation of the island became visible. It consists of three great volcanic cones, of which only one is now active. The highest summit, Mauna Kea, is nearly 14,000 feet above the level of the sea; the next, Mauna Loa, lacks but a few hundred feet of this; yet so great is the breadth of these masses that one fails to realize their immense height. Our first landing was at Mahukona, on the leeward side of the island, a most forlorn expanse of bare lava with scarcely a trace of vegetation, except a few unhappy looking algaroba trees planted about the straggling buildings that constituted the hamlet.

We lay all day at this inhospitable station, not getting away until evening. A beautiful sunset and a fine glimpse of the peak of Mauna Kea glowing with the last rays of the sun, form my most pleasant recollections of this desolate place.

What a change the next morning! On awakening we found ourselves entering the harbor of Hilo. Here everything is as green as can be imagined, and luxuriant vegetation comes down to the very ocean's edge. The town is built on a bay fringed with cocoanut trees and embowered in a wealth of tropical vegetation. Owing to the great annual rainfall (about 180 inches), as well as to the fact that Hawaii is the most southerly of the islands, the vegetation here is the most

luxuriant and tropical found in the whole group. I remained in Hilo for six days and collected some most interesting specimens. Through the kindness of Mr. Hitchcock of Hilo, I was enabled to spend the night at his camp in the woods near the town, and the greater part of two days collecting in the vicinity. The forest here is most interesting. Mr. Hitchcock was starting a coffee plantation and had cut trails through the woods in several directions so that collecting was very convenient. There is great danger of losing one's self in these woods where there are no trails, as much of the forest is an almost impassable jungle. In these moist forests ferns and mosses luxuriate, and every trunk and log is closely draped with those beautiful growths. Flowers are almost entirely wanting, a fact repeatedly observed by collectors in tropical forests. I saw here fully developed specimens of tree-ferns. The finest of these were species of Cibotium. Many had trunks from fifteen to twenty feet high, and some must have been fully thirty. The most beautiful were some with trunks ten to fifteen feet high, as these were more symmetrical and had finer fronds than the taller ones. I measured the leaves of one that had fallen over, and roughly estimated the length as eighteen feet. I have no doubt that specimens fully twenty feet long could be found. These giant fronds, arching high over one's head as one rides on horseback under them, present a sight at once unique and beautiful. Growing upon the trunks of these ferns were many epiphytic species, the most peculiar of which was Ophioglossum pendulum, with long strap-shaped leaves, a foot or two long, and a spike of sporangia sometimes six inches long. Exquisite species of Hymenophyllum and Trichomanes, the most ethereal of all the fern-tribes, with almost transparent, filmy leaves, were common, sometimes completely enveloping the trunks of the trees. Of the terrestrial ferns, which abounded everywhere, two were especially notable as representing groups unknown in the United States. One of these, Gleichenia dichotoma, forms extensive thickets on the borders of the forest, and in the Hilo district extends down almost to the sea-level. The other, Marattia Douglasii, a very large fern with leaves eight to ten feet long in well grown specimens, has fleshy dark green leaves, and thick stipules sheathing the base of the leaf-stalks. Several species of Lycopodium and Selaginella were common, and a good

variety of mosses and liverworts. In these forests wild bananas are common, and most magnificent plants they are. Sheltered from the wind, the superb great leaves develop to their full size, without being torn in the least, and the whole plant is a study of beautiful form and color.

Coffee is being extensively planted in this region as well as upon the lee side of the island, and as the quality of the berry is exceptionally fine, this promises soon to be a leading industry in the Islands.

About Hilo especially, but common also elsewhere, was a very conspicuous black fungus, that covered the leaves completely in many cases, and attacked indiscriminately a great variety of trees.

From Hilo I proceeded to the volcano of Kilauea, some thirty miles distant, and about 4,000 feet above the level of the sea. As this volcano has so often been the theme of travellers' descriptions I will not linger over it. In the vicinity are many interesting plants, among them a species of Vaccinium with sub-acid yellow and red berries something like cranberries. These "ohelo" berries are much esteemed, and are especially good when cooked. Some two miles from the volcano is a superb grove of koa trees, the largest trees I saw anywhere in the Islands. One of these standing alone, and with magnificent spread of branches, must have been ten feet in diameter. The road to the volcano lies for much of the way through a fine forest. In the lower part the ohia trees were loaded with their beautiful crimson fruit and present a very showy appearance. Of flowers, the species of Ipomœa were the most conspicuous; but the scarlet flower-bracts of Freycinetia were conspicuous at times, for here this latter plant may often be seen running to the tops of the tallest trees.

The glory of this road, however, is the tree-ferns, which all along excite one's admiration. The carriage road is not yet completed, and about thirteen miles must be done on horseback. Of this more than a mile is over a corduroy road made out of the trunks of ferns! Such a road, if not very durable, is yet very pleasant to horses. As these trunks lay prostrate, in the damp atmosphere, most of them were already sending out new fronds, and in due course of time, the road will be fringed with a hedge of great fern-leaves. Indeed, in some of the more open parts of the road farther

down, where the ground is completely occupied by a small tree-fern growing in dense thickets, as these are grubbed out to make way for cultivation, their trunks are piled up to form fences, and soon sprout out so that they make a beautiful and close hedge of fern-leaves.

On leaving the volcano, I went down on the other side of the island. The rain being almost entirely intercepted by the mountains, this leeward side is very dry, and the ride to Punaluu, where we were to take the steamer was not especially pleasant. Vegetation is very scanty, and nothing particularly interesting was noted in this line. The soil on this side of the island, especially in the district of Kona, is very fertile, and when water can be had, produces magnificent crops of all the tropical staples, pine-apples, cocoa-nuts, coffee, sugar, etc., all especially fine; and we feasted on these cocoa-nuts and pine-apples as we sailed along this picturesque, if somewhat barren, coast.

A short, flying trip was made to the Island of Kauai, the richest botanically of all the islands, as it is the oldest geologically. According to Hillebrand, not only is the number of species larger than in the other islands, but the species are more specialized. Here I saw several species of the curious woody Lobeliaceæ, of which there are several genera that form either shrubs or small trees. I saw several species of Cyanea, with stems six to eight feet high, with long leaves crowded at the top of the stem and many white or purplish flowers, much like those of Lobelia, but somewhat larger and less open.

As in all the islands, there is on Kauai a great difference between the windward and leeward sides. I drove for about thirty miles along the windward side of this island through some of the most beautiful scenery of all the islands. Near the sea, were rolling plains and hills, with here and there groves of Pandanus and Hau — the latter a dense spreading small tree with large yellow hibiscus-flowers — and at one point we drove through a magnificent grove of kukui trees, the finest I saw anywhere. As we reached that part of the island which is most fully exposed to the moisture-laden trade-winds, vegetation became extremely luxuriant. Numerous valleys with clear streams flowing down them, their bottoms given up to rice plantations, were to be seen here, with the rice in all stages from the young spears just stand-

ing above the water to golden-yellow patches of ripe grain. At Hanalei, my destination, I found excellent accommodation and a delightful bathing beach, the latter especially attractive after a thirty-five-mile drive over dusty roads. Hanalei is beautifully situated on a picturesque bay with bold mountains rising directly back. The next morning a native was hired to go with me into the woods, and the day was spent in collecting. The variety of trees, as well as other phaenogams, is much greater here than in Hawaii; the ferns, also, were very fine. Here I obtained a prize in a fine lot of the prothallia and young plants of Marattia, as well as some other interesting things.

Want of space forbids going into details, but no botanist visiting the islands can afford to miss Kauai.

In position, the Hawaiian Islands are unique, being more isolated than any other land of equal area upon the globe. More than 2,000 miles separates them from the mainland, and 1,860 miles from the nearest high islands. Of purely volcanic origin, thrown up from an immense depth, they have always been thus isolated. As might be expected, the flora is very peculiar, more so than in any other country. According to Hillebrand, of 800 species of spermaphytes and pteridophytes that are strictly indigenous, 653 or seventy-five per cent. are endemic. Taking out the pteridophytes, the spermaphytes show over eighty-one per cent; and the dicotyledons over eighty-five per cent. that are found only in this group.

For a thorough study of this very curious flora, a long time would be necessary, as many species are extraordinarily local, and many of the most interesting localities are very difficult of access. The islands differ extremely among themselves, and exhibit in a most interesting manner the correspondence that exists between the variety and differentiation of forms and the ages of the islands. The formation of the islands has proceeded from north to south; and Kauai, the northernmost of the large islands of the group is also the oldest and much the richest botanically, especially as regards spermaphytes; and, according to Hillebrand, the genera and species are more differentiated. Hawaii, the southernmost of the islands, is much the poorest in forms, although in the Hilo district the conditions are most favorable for a luxuriant development of forms.

In the latter island is the last active volcano of the group, Mauna Loa with its two creaters, of which the well-known crater of Kilauea is the great sight of the islands and visited constantly by tourists from all parts of the world.

A few days after my return to Honolulu from Kauai, and six weeks from my first arrival there, I boarded the Monowai, the through Australian steamer bound for San Francisco, which was reached in due season after an uneventful passage. And so ended my first trip to the tropics.

Leland Stanford Junior University.

Botanical papers presented at the New Orleans meeting of the American Association of Agricultural Colleges and Experiment Stations.

L. H. PAMMEL.

The botanists in attendance at the New Orleans meeting were not numerous, and the same may be said of the horticulturists. On invitation of the botanists, the horticulturists met with them. The association later united the sections of botany and horticulture.

Papers enough were presented to take at least a forenoon and an afternoon, but owing to the meetings of the general sessions it was impossible to get all of the members together at any one time. The meetings at different times could only be an hour long. The meeting on Thursday morning was devoted to the important topic of the station and laboratory exhibit at the World's Columbian exposition, which was discussed by Dr. True and Prof. Tracy.

It would seem that more time should be given to a discussion of methods of investigation and more time allotted to the different sections. Botanical investigations appear to the writer to be an important part of station work.

The following papers were presented:

BYRON D. HALSTED: *Quince diseases.*—The following fungous troubles of the quince fruit were treated, namely: The quince rust (*Rœstelia aurantiaca* Pk.); the fruit spot (*Entomosporium maculatum* Lév.); the black rot of the quince (*Sphæropsis malorum* Pk.); the quince pale rot (*Phoma*

Cydoniæ Sacc.)?; the ripe rot of the quince (*Glœosporium fructigenum* Berk.), and the quince blotch, due to a fungus the life history of which is not yet worked out and whose affinities are obscure.

The black rot is the same as that of the apple and the fact that this was unusually destructive seems due to there being a large apple tree among the quince trees with the ground beneath it covered with fruit decaying with the sphæropsis. The pale rot may prove to be a new species, as *Phoma Cydoniae* Sacc. has a very incomplete description and is recorded only for leaves. By inoculations it was shown that the ripe rot is the same as that of the apple and grape, namely, *Glœosporium fructigenum* Berk. These various decays were photographed.

BYRON D. HALSTED: *New Jersey Peronosporeæ.*—After recording the substance of the field notes made upon the various species, stress was laid upon the fact that during the autumn months, which were unusually dry, there was more than the ordinary amount of the members of the genus Cystopus. While the peronosporas prefer a wet season, the white moulds seem to thrive best when the weather is dry. In a further study of the methods that these mildews have for passing the winter, it was found that some species grow upon the fruits of the host and doubtless, as in *Ipomœa hederacea*, the filaments penetrate the seeds, and when the latter germinate the parasite develops with the host. Large numbers of small young seedlings badly affected in the cotyledons, and roots even, were taken.

The importance of making field notes upon the prevalence of particular fungous parasites extending over many seasons was urged in the paper.

BYRON D. HALSTED: *Weed seeds.*—Samples of a collection of weed seeds then being made by the writer were exhibited, for an account of which, see this journal, XVII, 427.

GEORGE F. ATKINSON: *On a method of obtaining a pure culture of Pammel's fungus of Texas root rot of cotton.*—Printed in full in this issue.

GEORGE F. ATKINSON: *A new "damping off" fungus.*—"Damping off" has usually been attributed to *Pythium De Baryanum*, but Atkinson found in young cotton affected with what is commonly called "sore shin" among planters, *Rhizopus nigricans*, *Fusarium*, and a non-fruiting form of a fungus

having threads from 9μ to 11μ in diameter and 100μ to 200μ in length, colorless at first, finally becoming brown. The fungus was isolated and grown in acid nutrient agar. Plants grown in sterilized soil when inoculated with this fungus dropped over and had this characteristic fungus. The same fungus was obtained from the inoculated plants. The author concludes that probably much of the damage attributed to *Pythium* is caused by this fungus.

L. R. JONES: *The antagonistic relations of certain potato diseases.*—Three diseases have been observed in Vermont, (1) blight and rot, *(Phytophthora infestans)*; (2) the macrosporium disease; (3) a bacterial disease. The phytophthora disease, and the macrosporium disease, or a disease associated with Macrosporium has been very common in Vermont in 1890, 1891 and 1892. He has watched these diseases and noted that there is an annual struggle between them. "It is comparatively rare that a tuber affected by the characteristic dry rot of Phytophthora is found among the tubers where the vine is destroyed by the new disease." The author concludes that if the climatic conditions remain as they have during the past three years in Vermont and only early potatoes are planted, the new disease would tend to exterminate the *Phytopthora.*

L. H. PAMMEL: *Preliminary notes on a rutabaga and turnip rot.*—The disease is not associated with any of the higher fungi, but there are present in the tissues numerous bacteria. Cultures of several species have been obtained, and one of these apparently produces a rotting similar to those found in the field. The inoculated plants were in the field so the demonstration is by no means conclusive. More work is under way. A curious feature in connection with the disease is that the dry weather in September not only checked the disease completely, but such plants as had rotted almost entirely recovered by forming a corky layer around the diseased portions.

L. H. PAMMEL: *Some experiments in the prevention of Cercospora Ribis and Cylindrosporium Padi.*—The author detailed some experiments in treating these diseases with ammoniacal carbonate of copper, Bordeaux mixture, and sulphosteatite. Bordeaux mixture proved most effective, the plants having retained their foliage well into October. In 1891 ammoniacal carbonate of copper gave good results, but

the season was more favorable. In seasons like 1892 with an abundance of rain the sulphosteatite and ammoniacal carbonate of copper wash off much easier then the Bordeaux mixture.

L. H. PAMMEL: *Relation of frost to certain plants.*— This paper gave a record of the exact temperature at which certain plants were killed. In several cases like castor-oil bean the lower leaves were affected while the upper long remained green. So also *Zea Mays*, *Scabiosa atropurpurea*, *Marrubium vulgare*, *Nepeta cataria*, *Phlox Drummondii* and *Cosmos* are quite resistant to frost.

S. A. BEACH: *Bean anthracnose and its treatment.*—It has been known for some time that when anthracnosed seed is planted the disease most frequently is found on the cotyledons as soon as they push through the surface of the soil, but it may be found on any other part of the plant above the roots. Experiments made in treating the seed and plants as compared with clean seed show that the selection of clean seed is the most important and effective method of securing healthy plants.

Iowa Agricultural College, Ames.

BRIEFER ARTICLES.

The use of blue-print paper in recording root curvatures.—The common blue print paper so much used by photographers, architects, and mechanical engineers, is not, so far as we are aware, of frequent use in botanical laboratories; yet it may be employed for a number of purposes with a considerable saving of time. We have found it particularly valuable in printing the angles of both primary and secondary roots that have been subjected to galvanic currents, and also in printing the geotropic bendings of secondary roots, to make an accurate drawing of which would require considerable time; whereas an exact reproduction can be obtained in a very few minutes. This is most easily accomplished if we have either an air or water culture, by fastening a piece of the sensitive paper to the outside of the glass jar in which the plants are growing, and exposing them for a few moments to sunlight. It is better still, especially if the plants are cultivated in cylindrical jars, to transfer them to a rectangular glass jar filled with water, and of sufficient size as to allow the secondary roots to main-

tain their natural position. Such a jar as is commonly used for the cultivation of seedlings answers well for this purpose. The sensitive paper can be fastened to the back of the jar by means of soft wax. The object should be exposed to strong sunlight, and a window should be chosen in which the direct rays can be reflected horizontally from a mirror upon the object, which in turn projects its shadow upon the sensitive paper. The object should be placed as near the paper as possible so that a well-marked shadow is obtained, and consequently a clearly defined print. From two to five minutes exposure in strong sunlight is sufficient to obtain a print, after which the paper should be treated to a water bath and dried in the usual way.— GEORGE E. STONE, *Leipzig*.

A new order of Schizomycetes.— The following should be substituted for lines twenty-two to thirty in the preceding number of this journal, p. 403.

Myxobacter aureus n. sp.— Plate XXV, figs. 34–36.— Colonies when rising to form cysts milky white. Rods large, cylindrical, rounded at either end, $4-7\times.7-.9\mu$. Cysts spherical or oblong, golden yellow, thick walled, one to twelve or more in number, distinct within a hyaline matrix, $75-350\times75-275\mu$. The encysted rods mingled with a yellow oily material. Cyst groups .7—1^{mm} long.

On very wet wood and bark, in swamps. Kittery Point, Me., Belmont, Mass.

Myxobacter simplex n. sp.— Rods as in *M. aureus*. Cysts solitary within a thin envelope, very large, irregularly rounded, bright reddish yellow, 250–400μ in diameter. The encysted rods flesh-colored in the mass and adhering in numerous elongate groups.

Occurring, sometimes with the last, in the same localities and habitat.

The two species above described are very common in the situations mentioned, being found most frequently on sticks lying in partly dry wood pools. In general appearance they greatly resemble a minute Trichia, and are conspicuous from their very bright color. The cysts or groups of cysts are never crowded, and are usually sparsely scattered over the substratum. Neither of these forms has been cultivated apart from its natural substratum. In *M. aureus* all stages of development have been obtained from the first appearance of the rising rod mass. The cysts are formed from this mass by a rolling together of the rods at certain points corresponding in number to the cysts to be produced. As the cysts roll themselves together, they become gradually separated from the hyaline matrix in which they are finally imbedded. The

cyst wall in both species is thick and clearly defined, the contents becoming contracted and clearly separated from it on the addition of glycerine or salt solution. The two species seem to be quite distinct, the reddish color and peculiar grouping of the cyst contents of *M. simplex* as well as its solitary habit being apparently constant characters.— ROLAND THAXTER, *Cambridge, Mass.*

EDITORIAL.

THE TIME is ripe for the establishment of a School of Botany in connection with some one of our large universities. In most of them, this great biological science is represented by a single man with or without assistance, and most of these men are considered fortunate that they are not compelled to teach zoology also. But in this respect there has recently been rapid improvement, and botany to-day stands fairly well differentiated. But we are now advocating further advance. The field of botany has become so vast that one man cannot stand for it all, and of necessity does injustice to the science and to his pupils. If a teacher is worth anything he is cultivating some one phase of the subject, and is impressing his pupils with the importance of that phase. The consequence is that our smaller colleges are being filled with botanists who know only one kind of botany, which is perfectly right and proper, and think every other kind of little or no consequence, which is by no means right and proper. These teachers lack a true perspective of their subject, and propagate the little dogmas of their training schools as persistently as do the religious sects their creeds.

IT IS THIS BROAD VIEW that was lost when botanists were compelled to specialize; and this view is to be restored by the establishment of schools of botany, in which, as in the Pantheon, all views are represented. It must not be supposed for a moment that we are advocating a diffusion of botanical training for the individual; but a student being trained in one department of botany can be made to appreciate the proper importance of other departments that are being cultivated about him. In addition to this a certain amount of elementary training in all the great departments is necessary, and this can be best directed by those who stand for these departments. It is urged that any good botanist can give a sufficient elementary training in the whole subject. We consider this to be a fallacy. It may be true for a a year or two after the teacher has passed from under the guidance of

distinguished specialists, but how can he be expected to keep step with the rapid advance in every department? It is our opinion that more antiquated anatomy and physiology, to say nothing of taxonomy (which of course includes the facts of morphology), are being taught in this country by well known botanists than we would care to acknowledge. Anatomists (still called histologists in some quarters) are apt to give little or no conception of modern physiology, and none whatever of our fluctuating taxonomy. Taxonomists (both in specific and genetic lines) are likely to be fair anatomists, but simply retailers of an obsolete physiology. As for physiologists, we may be said, as yet, to have none. We have some fair "readers" of the subject, and others who are mechanically expert enough to devise pieces of apparatus, but as a distinct department in this country, physiology is yet to be established.

A SCHOOL OF BOTANY would prevent this lop-sided presentation of the subject, and would develop a race of botanists with broader views. Such a center of investigation and instruction will doubtless soon be established, as educational matters are moving just now with remarkable rapidity.

CURRENT LITERATURE.

Handbook of British Fungi.

Few systematic works, especially of those relating to cryptogams, have enjoyed such a long period of uninterrupted usefulness as Cooke's "Handbook of British Fungi," published in 1871, in two volumes. Although long since out of print, the demand for it has not abated, as the high price in the second-hand catalogues fully shows. Its popularity was not due to its ever having been a satisfactory work, but to the fact that it was the only work covering the ground. The number of species included in it was 2,810, while the number now recorded for the same territory is about 4,900. There have also been great advances in the classification of the fungi in the last two decades.

In view of these facts the announcement of a new handbook like the old one, but "with all the modern improvements," gives much satisfaction. The new work is to be in three volumes, the first one being already before us. It is prepared by Mr. George Massee,[1] and in size and general appearance resembles Cooke's work.

[1] MASSEE, GEORGE. — British fungus-flora: a classified text-book of mycology. 3 vols. 8vo. Vol. I. pp. xii. 422. Illustrated.

This first volume is devoted to the Basidiomycetes, beginning with the Gasteromycetes. The descriptions are accompanied with few critical notes, and no indication of geographical distribution, or relative abundance, which will somewhat curtail its usefulness to American students. The few illustrations are crudely drawn and wretchedly printed. The typography and general make up of the volume are, however, excellent.

There is much difference of opinion regarding the limitations of species and genera, especially in the Hymenomycetes, and the present work shows a number of deviations which will not be satisfactory to many. The matter can better be discussed elsewhere, however; it will suffice to note that the genus Agaricus is cut down until it includes only twelve species, while in Cooke's Handbook it embraced 452 species, and in Stevenson's recent Handbook of British fungi it embraces 782 species.

A botanical dictionary.

For a long time there has been much need for a revised dictionary of botanical terms. The recent rapid growth of the science and its extension into new fields has introduced many technical terms not found in former works of the kind, of which the last one issued was by Paxton and Lindley, dated 1868. The work by A. A. Crozier,[1] from the press of Henry Holt & Co., is therefore a timely publication. It defines over five thousand words, very few of which are obsolete terms. The vowel sounds and accent of the words are indicated, but the derivation is not given. Not only exclusively technical terms are given a place, which are for the most part also found in the Century dictionary, but also other words, which have beside their usual meaning a special botanical application, e. g., accessory, aggregation, entire, drooping.

It is not surprising to find that the work does not include all the terms which the reader of recent botanical writings may desire to have defined. Sometimes the word is included, but without mention of the particular specific application of it, e. g., hadrome, leptome, stereome, bulliform, as descriptive of certain peculiar structures in grass leaves. Sometimes the word is omitted entirely, e. g., aërotropism, carene, chemotactic, thermotonus. The number of omitted words, especially of those belonging to vegetable physiology, appears to be considerable, but possibly not larger than any compilation would be likely to show upon its first issue. If the book meets with the suc-

[1] CROZIER, A. A.—A dictionary of botanical terms. 8vo. pp. 292. Henry Holt & Co., New York, 1892. $2.50.

cess it deserves, it will not be long before a second edition will be required, which should also be an augmented one.

It is particularly gratifying to note that for the first time in any dictionary the much abused words "fungoid" and "fungous" are correctly defined and their proper usage indicated.

The book is admirably printed and bound, and makes a convenient reference volume.

Minor Notices.

WEST VIRGINIA has been incompletely explored, and containing a knot of mountains that is neither northern nor southern, botanists have long regarded it as very desirable territory. Even a hasty survey has yielded rich results, as Dr. Millspaugh's Preliminary Catalogue[1], now before us, will testify. It will be impossible for us to note all the interesting features of the flora. The nomenclature used is practically in accord with the Rochester rules, and several combinations appear for the first time. The catalogue includes not only all the observed existing flora, from *Clematis* to *Epicoccum*, but a supplement presents to us the rich fossil flora of the State. Quite a number of new species are described, the two plates illustrating a new moss and a new liverwort. The list contains, exclusive of the fossil flora, 1,189 species of phanerogams, 39 pteridophytes, 107 bryophytes, and 164 thallophytes, 1,499 in all; to which number may be added numerous varieties and forms. Dr. Millspaugh has been unfortunate in his state printer, a thing with which others who print without proper control of the proof can sympathize.

THE CONIFERS have long occupied the attention of the distinguished editor of the *Gardeners' Chronicle*, Dr. Maxwell T. Masters. There are now before us two reprints[2] containing some of the results of his labors. The Chiswick address is a very interesting presentation of this important group of plants, and its completeness may be judged from the following captions: antiquity, genealogy, stages of growth, physiology, movements, etc., practical illustrations, beauty of form and color, stature, utility, nomenclature, introduction of species into cultivation, economic value.

[1] MILLSPAUGH, CHARLES F.—Flora of West Virginia. Bulletin No. 24 of W. Va. Agricultural Experiment Station, Morgantown, W. Va. 1892, pp. 314–538, with two plates.

[2] MASTERS, MAXWELL T.—(1) Some features of interest in the order of Conifers, being an Introductory address at the Chiswick Conifer Conference (Oct. 1891). [Reprinted from Jour. Roy. Hort. Soc. XIV, pp 20.] (2) List of Conifers and Taxads in cultivation in the open air in Great Britain and Ireland. [Reprint, l. c., pp. 80.]

The more important "list" is introduced by an account of the literature of the group, following which the genera and species are presented alphabetically. The literature, synonymy, and native habitat are fully cited, and as most of our North American species are cultivated in the British Isles the list becomes quite a complete bibliographical index of the group for American botanists. In regard to nomenclature the author has followed the principles of Bentham and Hooker, so that the names adopted are not to be considered as representing the most recent agreement concerning nomenclature.

DIONÆA has always been a fascinating study, and although its history seemed to be fully written, Mr. Bashford Dean[1] has given us a most interesting account of its actions in its native haunts, and has supplied us with valuable information. It has always been a question whether we were getting at all the facts from the study of greenhouse specimens. Mr. Dean summarizes some of his results as follows: (1) Specialization for the capture of ground insects. (2) Marked differences in irritability in individual leaves; the usual inability of the plant to capture and retain larger and more active insects; the usual failure of the plant to capture transient insects; the repeated closings of the trap upon inorganic and vegetable objects. (3) The sensitiveness of the trap in parts other than the filaments. It would seem that the name "fly-trap" is singularly inappropriate.

THE FLORA of Lower California promises to be as prolific of new things as that of Mexico. Mr. Brandegee has already published a voluminous report of this region, and has now issued[2] a small pamphlet containing "additions," which were the result of a trip to the Cape region in March and April of 1892. In addition to interesting plants already described, we note four new species, three of which are *Leguminosæ* (Dalea, Acacia, and Albizzia). The occurrence of an Albizzia in our N. American flora is unexpected, as the genus was thought to be confined to warm regions of the orient.

THE FLORA OF MEXICO, owing to the persistent activity of that wonderful collector, Mr. C. G. Pringle, is being rapidly brought to our knowledge. It is also a very great advantage that so much of this rich flora is to be represented by such fine material as types. Dr. B. L. Robinson, the new Curator of the Harvard Herbarium, has been working at

[1] DEAN, BASHFORD.—Dionæa. Its life habits under native conditions. From observations made near Wilmington, N. C. (April 1891.) [Reprinted from Trans. N. Y. Acad. Sci., 12. pp. 9.]

[2] BRANDEGEE, T. S.—Additions to the Flora of the Cape Region of Baja California. [Extract from Proc. Cal. Acad. Sci., II. III. 218–227.]

the Pringle collections of 1890 and 1891, and has just published[1] some of his results. Nearly forty new species are described, the majority of which are *Compositæ*. Two new genera are proposed: *Coulterophytum*, a genus of umbellifers belonging to *Selineæ*; and *Geissolepis*, a genus of composites belonging to *Galinosogeæ*. We regret the omission of the index, which always made Dr. Watson's contributions so easy to use, and a thing which Dr. Gray never would provide.

OPEN LETTERS.

The meeting at Madison in 1893.

No one need fear that there is not enthusiasm among the botanists of America. There is an unlimited supply of botanical enthusiasm in the air. The whole atmosphere is electric with it and the only problem is how to collect a little of this universal enthusiasm for the meeting at Madison. The meeting is the Leyden jar that must be charged from the general botanical atmosphere of the country. I have one practical suggestion to make and that is this: Let a plan be outlined for a complete exhibit at the Madison meeting of photographic views of the different botanical laboratories of the country. Let the gathering together of this exhibit be placed in the hands of some committee that will be willing to give some careful thought to the administrative detail of the whole matter and let it be advertised thoroughly so that the exhibit will be a complete one and a creditable one. To the "distinguished foreign guests" promised us by the GAZETTE such an exhibit would be peculiarly grateful and it would be a delicate attention on our part to present before this extracontinental contingent our material aspect together with our intellectually inspiring papers.

It is not only to the foreign botanist that such an exhibit would be valuable but particularly also to those misguided fellow-citizens in science who are unable to get beyond the notions of their childhood about botanical methods and still believe that the botanist is a man who analyses flowers and busies himself principally with the beauties and incidentally with the sterner realities of Nature. My old friends the "biologists," whom I have often had occasion to reprove more in sorrow than in anger, will be benefited, I know, by such an exhibit and it might in some degree compensate them for the absence in the future from their sectional meetings of the refining, broadening and inspiring influence of the botanists.

And even the leaders of the zoological wing might be afforded some information that would be of value to them by such an exhibit. I

[1] ROBINSON, B. L. — Descriptions of new plants collected in Mexico by C. G. Pringle, in 1890 and 1891, with notes upon a few other species. [Reprinted rom Proc. Am. Acad. 27. pp. 165–185.].

have in mind the unfortunate wording of the *Programme of Courses in Biology* at the University of Chicago which has recently come under my eye. In it I discover a classification of the biological sciences that is, as I have characterized it, unfortunate, for it comes under the supervision of a very able zoologist and consequently from a region whence we might have looked for better things. Under the head of "organization of the school" six departments are mentioned. These are: 1, zoology; 2, anatomy; 3, neurology; 4, palaeontology; 5, physiology; 6, botany. From such a classification it is plain that the position of botany in a *true* classification is not apprehended. The erroneous use of the word botany in such a connection is no less remarkable than the erroneous use of the word zoology as exclusive of anatomy, for example. But this will hardly palliate the offence against accurate use of terms in the setting off of botany as coördinate with palaeontology or neurology, and such parallelism is clearly indicated in the grouping used in the circular before me. It is a matter of regret to us all that in an institution of so much promise as the new Chicago University there should be so evidently retrogressive a movement. While over the world and here at home in our Association there is seen going on the segregation of the different branches of biological science and the accurate limiting of their fields, this classification of the Chicago programme is a movement backward to the old natural-history group (though under another name); and even in this group there is what a humble botanical worker with no pretensions to the name of biologist must be permitted to say is contrary to what he has been taught is an exact use of words, and certainly opposed to what he has been led to believe by study and reading and observation to be a correct classification of science-groups.

If a display of the material side would have any effect upon the minds of these wanderers from the philological fold, I suggest that the botanists present it, for their science, at Madison in 1893.— CONWAY MACMILLAN, *University of Minnesota.*

An International Botanical Congress.

Since the meeting of the botanists at Rochester last August it has become evident that an international botanical congress should be held in 1893 in this country. Upon the return of Professor Underwood from Genoa, with his report of what was done there, as well as of what was left undone, such a congress seemed a necessity, especially when it was learned that the delegates to the Genoa congress expected one to be held in America this year in order to complete the work left by them. The Columbian Exposition will doubtless bring many botanists to this country during the year. Most of these will attend our scientific meetings if possible, and it seems wise to take advantage of this and to arrange for a formal congress. There being no committee to take charge of the work of preparing for the congress, after consultation with a number of botanists, it was thought advisable that the chairman of the Section of Botany of the American Association for the Advancement of Science, and the president of the Botanical Club, Dr. Wilson, should appoint a committee to take the matter in hand. Accordingly on Dec. 9th, notices were sent to the following gentlemen

with the request that they serve on such committee: J. C. Arthur, L. H. Bailey, N. L. Britton, D. H. Campbell, J. M. Coulter, B. T. Galloway, Conway MacMillan, B. L. Robinson, William Trelease, L. M. Underwood, George Vasey.

May I not ask a hearty support be given to the committee by every botanist, to the end that the congress may be every way successful.—CHARLES E. BESSEY, *Chairman Section G (Botany), A. A. A. S.*

Lesquereux's Flora of the Dakota Group: A reply.

In the October number of the GAZETTE I find a review of Lesquereux's *Flora of the Dakota Group*, which I seem to have been so unfortunate in editing. As this review is so evidently the vehicle of a personal attack, you will, I trust, grant me space for a few words of editorial explanation. My reviewer says: "The best method of editing a posthumous work is, undoubtedly, to carry it out in the same spirit in which it was written, taking all facts into consideration." Had he taken the trouble to read the editor's preface he would have seen that this was precisely what has been done. The only changes made in the MS. as submitted by Lesquereux, except such slight verbal ones as were necessary to make the meaning more clear, *are mentioned in foot-notes* (twenty-three in number) *signed with the editor's initials, and the whole, if gathered together, would not fill one printed page!* The book is Lesquereux's own, and the criticism therefore becomes one of the author, not of the editor.

But let us examine some of the so-called editorial blunders. There are, we are informed, "incorrect citations." As only high ecclesiastics lay claim to infallibility, it is not perhaps remarkable that out of nearly a thousand bibliographic references, including page, plate and figure, a few errors should creep in, but it would have been more satisfactory had some of them, or at least one, been pointed out! "The plates . . . . are poorly arranged." The plates are divided into three series, the first embracing forty-five plates, the second nineteen plates, and the third three plates, and the figures are arranged upon them (of course in three series) as nearly in systematic order as the size and character of the drawings will permit. This arrangement was fixed by the author before the editor assumed charge, for as stated in the editor's preface, the book was completed once, and sent to Washington, but before it could be taken up for publication a great amount of new material was discovered in Kansas, and Lesquereux asked that the manuscript and plates be returned to him. This new material added 110 new species and twenty-one plates. Lesquereux left figures for nineteen of these plates, and the remaining three were made under the supervision of the editor. The author made hundreds of references and cross-references to the plates as thus arranged. To have changed this arrangement would not only have involved many errors, but was actually impossible, for the tint of the India ink work was not the same on the last series of plates as on the first, and hence they could not have been reproduced by the mechanical processes required at the government printing office, had the two kinds been mixed on the same plate.

"The spelling of names is inconsistent." It is indeed a *gross* typo-

graphical error that we should have both *grossi-* and *grosse-dentatum!* "Often the specific name is in the wrong gender." *Fagus orbiculatum* is wrong in the text, but is correct in the plate, and would have been changed, as were the fifteen subspecies of *Betulites* (p. 61), had it been noticed in time. The species of *Sassafras* pointed out as being in the wrong gender, were first printed by Saporta and Heer in this form, and have been adopted in most European works for upwards of twenty-five years. It was not assumed to be the function of an editor of a posthumous work to make corrections of this character, notwithstanding the fact that the reviewer says: ". . . there are many things that are admissible in a manuscript, written as the thought first comes to us, and pleasing for a time to the fancy, which should be omitted in print!" (It is a matter of great regret that no general rule for the application of this principle was laid down for the guidance of future editors.)

"Misleading phrases; *e. g.*: 'dots like the impression of basilar points of hairs.'" Basilar parts of hairs would have perhaps been better, but the phrase is not misleading as it stands, for when a leaf covered with a firm pubescence becomes fossilized, the impression bears the imprint of the bases of the hairs on which they appear like dots, as stated by Lesquereux. Again, the expression "A bunch of small pediceled seeds like a *Carex*" is general and popular rather than misleading, for every one knows that technically the fruit of *Carex* is an achene (the fruit of *Citrus Aurantium* is a superior polycarpellary syncarpous plurilocular berry, yet some people still call them oranges!), which is often called, and for all popular and practical purposes *is* a seed. The resemblance of the fossil under discussion to a bunch of the fruits of *Carex* is clear enough.

"Furthermore, there is a too indiscriminate use of terms, *e. g.*, basal basilar and basil." The first two words are of course synonymous and correctly employed, while the other (basil) is another one of those unfortunate typographical errors which the reviewer has so kindly pointed out! It should be *basal*. The quotation under *Protophyllum denticulatum* is garbled and misleading as quoted, but is self-explaining when presented in full. Following is the complete text (p. 193) the italicised words representing the parts taken: "Leaf coriaceous, round or reniform, enlarged on the sides, truncate at the base, minutely but sharply denticulate all around except at the base, petioled; *median nerve* thick, percurrent; *lateral primaries supra-basilar*, very open, the upper branched outside, the lower simple, thin, at right angles to the midrib; *secondaries* four pairs, subopposite, more or less branching, craspedodrome *with their divisions; nervilles* at right angles to the secondaries, distinct, simple or forked."

"On page ninety-two we learn that 'the nerves are attached to each other.'" There is no such expression on this page or anything that can be distorted into it. The statement that there is but one species of *Diospyros* in North America is of course not quite true, for there is another relatively unimportant species (*D. Texana*) in southern Texas. The claim that there are illustrations not named is not supported by facts, and that "there are others not numbered" is true in only one case, plate XXI fig. 1, which is instantly restored, by people of ordinary intelligence, by exclusion.

Thus the array of *so-called* editorial blunders seem to resolve themselves into a few simple typographical errors, which every one who has anything to do with printing, must know how difficult it is to keep out of a work of this magnitude (400 pages, sixty-six plates), and while the general public may be able to "readily observe the wide gap between the genial and elegant work of Lesquereux and the lack of care and taste in the present edition," the editor earnestly begs them to look in the book for themselves, and throws himself upon their mercy.— F. H. KNOWLTON, *Washington, D. C.*

NEWS AND NOTES.

AT ITS LAST anniversary meeting the Royal Society awarded the Darwin Medal to Sir Joseph Hooker.

DR. G. VON LAGERHEIM has resigned his position in Quito, Ecuador, and gone to Tromsö, Norway, which is his present address.

AS WE GO to press word has been received of the death of Mr. I. C. Martindale, of Camden, N. J. His botanical specimens are known in many collections, and his own herbarium is one of the largest private collections in this country, and was always in most exemplary order.

MR. FRANCIS DARWIN, son of the great naturalist, and the joint author of *The Power of Movement in Plants*, at present Reader in Botany at Cambridge, has, on the nomination of Professor Babington, been appointed Deputy Professor for the current academical year.— *Gard. Chron.*

"THE COLLECTION of cycadeous plants in cultivation at Kew stands unrivalled, both in regard to the number of species represented, and the size of the specimens generally." This sentence introduces a very interesting account of the Kew Cycads, to be found in *Gardeners' Chronicle* (Oct. 22).

A NEW MONTHLY JOURNAL of botany is promised to make its appearance this month. It will be under the direction of members of the Botanical Department of the University of California, and under the editorial charge of Mr. Willis L. Jepson. Its name is to be *Erythea*, and its price $1.50.

THE SIMULTANEOUS publication in the GAZETTE and the *American Naturalist* of Dr. G. W. Martin's paper on the development of the flowers and embryo-sac in Aster and Solidago was entirely unexpected by the editors of either journal. The author sent a copy to each without notice of the duplication, and by accident the article appeared in the same issues of both magazines.

M. CASIMIR DE CANDOLLE has repeated (more elaborately) Sachs' experiments upon the flowering of plants under the influence of the ultra-violet rays. It will be remembered that Sachs considered these rays indispensable to the formation of flowers. DeCandolle finds them to be favorable rather than indispensable, and the question still remains unanswered how the rays act.

PROBABLY THE LARGEST specimen of *Acanthorhiza aculeata* Wendl. (a curious species of Central American palms) in cultivation in Europe has just bloomed for the first time at Kew. The generic name refers to the curious spinous roots, which in the species mentioned clothe the stem to a height of a foot above the ground.

THE STATE UNIVERSITY OF IOWA has sent Professor B. Shimek to Nicaragua, to follow the route of the canal as near as practicable and make a general investigation of the country; its general character (fertility, climate, etc.), its people, its geology, its flora (special attention being paid to the cryptogamic flora), and its fauna. It is expected that he will return to Iowa City with his collections not later than April 1, 1893.

MR. GEO. M. THOMSON, of New Zealand, has an interesting paper in *Science* (Dec. 9) entited "Biological Notes from New Zealand." We are delighted to see that under this caption our friend of the antipodes deals only with certain peculiarities of New Zealand plants! He notes particularly the rarity of those plant structures which are correlated with the presence of mammalia, such as spines for protection and hold-fasts for distribution.

MR. W. N. SUKSDORF, of White Salmon, has issued a catalogue of the phanerogams and pteridophytes of Washington. He has long been collector of that interesting flora, and his specimens are to be found in all our larger herbaria. As nearly all of his plants have been determined by eminent botanists, the recent catalogue can be relied upon. The list contains 1,642 phanerogams and 48 pteridophytes, and can be had of the author for 25 cents.

SEVERAL STATE ACADEMIES of science met during the holiday week. The program of the Nebraska society contains twenty-two papers, of which eight are upon botanical subjects. In Ohio there are thirty-seven papers upon the program, of which sixteen are botanical, in Iowa twenty-five papers of which eight are botanical, and in Indiana the program embraces ninety papers, of which twenty-five are botanical. These local societies appear to be flourishing, and are accomplishing a good work.

THE NATIONAL COUNCIL OF EDUCATION (a department of the N. E. A.), is considering the general subject of uniformity in school programs and in requirements for admission to college. President Eliot is the chairman of the standing committee of ten. This committee has appointed conference committees to discuss and report upon the different subjects. The conference committee on "Natural History" met at Chicago University, December 28th, and among its ten members are found the following botanists: Chas. E. Bessey, Douglas H. Campbell, and John M. Coulter.

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